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10/762,499

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Aarti Gupta

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SUGHRUE MION, PLLC
2100 PENNSYLVANIA AVENUE, N.W.
SUITE 800
WASHINGTON, DC 20037

EXAMINER

OCHOA, JUAN CARLOS

ART UNIT

PAPER NUMBER

2123

MAIL DATE

DELIVERY MODE

04/29/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/762,499	Applicant(s) GUPTA ET AL.	
	Examiner JUAN C. OCHOA	Art Unit 2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 March 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 76-79 and 81-84 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 76-79 and 81-84 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. The amendment filed 03/16/2009 has been received and considered. Claims 76–79 and 81–84 are presented for examination.

Continued Examination Under 37 CFR 1.114

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 03/16/2009 has been entered.

Claim Objections

3. Claim 81, line 5 refers to the term “up to some depth k”. Claim 81, line 20 refers to “said finite depth k”. Term “said finite depth k” may raise antecedent basis issues. Examiner interprets as “said depth k” for examination purposes.
4. Claim 81, line 5 refers to the term “environmental constraints”. Claim 81, line 9 refers to “the constraints”. Term “the constraints” may raise antecedent basis issues. Examiner interprets as “the environmental constraints” for examination purposes.
5. Claim 79 line 5 includes the typo (an extra period) “environmental constraint in the satisfiability solver. the said lazy constraint making”. Examiner interprets as “environmental constraint in the satisfiability solver, the said lazy constraint making” for examination purposes.

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6. Claim 81 line 5 includes the typo “property, and environmental”. Examiner interprets as “property and environmental” for examination purposes.
7. Claim 84 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. As per claim 82 (its independent claim), the method of claim 82 is already used to derive the abstract model at depth k.
8. Dependent claims inherit the defect of the claim from which they depend.
9. Appropriate correction is required.

Claim Rejections - 35 USC § 112

10. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

11. Claims 78 and 79 are rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. The meaning of “!” is critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). The disclosure refers to ‘, but not !.
12. Claims 82–84 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter

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which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The subject matter description of claim 82, lines 8–10: “until ... the size of the said abstract model of the sequential design of the electronic circuit remains unchanged over a predetermined number of consecutive depths” in the specification is non-existing.

Claim Rejections - 35 USC § 101

13. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

14. Claims 76–79 and 81–84 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

15. Claims 76–79 and 81–84 are directed to a process, in order for a process to be considered proper, the claimed process must either be clearly tied to a particular machine or apparatus or transform a particular article to a different state or thing.

Regarding the instant claims, the process does not meet either of these requirements and is therefore held as non-statutory.

16. Dependent claims inherit the defect of the claim from which they depend.

Claim Rejections - 35 USC § 102

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17. While the claimed subject matter is rejected under 112 as noted above, Examiner has applied prior art based on a good faith interpretation of the claimed language and delimited information provided in the specification.

18. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

19. Claims 82–84, are rejected under 35 U.S.C. 102(a) as being anticipated by McMillan and Amla, Automatic Abstraction without Counterexamples, (McMillan hereinafter). (See IDS dated 8/16/08).

20. As to claim 82, McMillan discloses a method for generating an abstract model for a sequential design of an electronic circuit for verification of a given correctness property, comprising : a) unrolling the sequential design of the electronic circuit to depth k (where k = kmin at the start) (see page 5, 4th paragraph) b) deriving an abstract model of the sequential design of the electronic circuit at depth k, that preserves correctness of the given correctness property up to depth k, when the given correctness property is not violated (see page 5, last paragraph) c) iteratively increasing k up to some limit kmax, and repeating above steps (see page 6, 1st–4th paragraphs) (a - c) until either the size of the said abstract model of the sequential design of the electronic circuit remains

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unchanged over a predetermined number of consecutive depths, or the limit k_{max} is reached (see page 6, 1st–4th paragraphs).

21. As to claim 83, McMillan discloses a method where the size of the abstract model corresponds to the number of flip-flops in the abstract model. (See “flip-flops” as “constraints” in page 6, 4th paragraph).

22. As to claim 84, McMillan discloses a method where the method of Claim 82 is used to derive the abstract model at depth k (see page 5, last paragraph).

23. Claims 81, 76, and 77 are rejected under 35 U.S.C. 102(e) as being anticipated by McMillan et al., (McMillan (2) hereinafter), U.S. Patent 7,406,405.

24. As to claim 81, McMillan (2) discloses a computer implemented method for generating an abstract model for a sequential design of an electronic circuit for verification of a given correctness property, comprising the steps of: (a) unrolling the sequential design of the electronic circuit with the given correctness property, and environmental constraints up to some depth k (see Fig. 2) (b) solving the resulting satisfiability problem to determine whether the given correctness property is violated (see Fig. 2, item No. 230) (c) deriving an unsatisfiable core from the proof of unsatisfiability when the given correctness property is not violated, where an unsatisfiable core is a subset of the constraints that is guaranteed to be sufficient for showing that the problem is unsatisfiable (see Fig. 2, item No. 240) (d) using the said unsatisfiable core to derive an abstract model of the sequential design of the electronic circuit for further verification of the sequential design, wherein, a subset of flip-flops and external constraint nodes of the electronic circuit are marked based on certain related

constraints being present in said unsatisfiable core the said abstract model consisting of complete combinational fanin cones of only the marked flip-flops and the marked external constraint nodes, such that outputs from the unmarked flip-flops are regarded as pseudo-primary inputs, and said abstract model providing a benefit that it is guaranteed to preserve the correctness of the given correctness property up to the said finite depth k (see Fig. 2, item Nos. 235 and 240).

25. As to claim 76, McMillan (2) discloses a method wherein a flip-flop is marked, if any of its corresponding latch interface constraints belong to the said unsatisfiable core a flip-flop is marked, if its initial state value constraint belongs to the said unsatisfiable core. (See Fig. 2, item No. 240).

26. As to claim 77, McMillan (2) discloses a method wherein a flip-flop is marked, if any of its corresponding latch interface constraints belong to the said unsatisfiable core a flip-flop is not marked if only its initial state value belongs to the said unsatisfiable core, in which case a constraint for this initial input is added to the abstract model without adding the flip-flop. (See Fig. 2, item No. 240).

Claim Rejections - 35 USC § 103

27. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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28. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

29. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

30. Claims 78 and 79 are rejected under 35 U.S.C. 103(a) as being unpatentable over McMillan (2) as applied to claim 81 above taken in view of Marques-Silva and Sakallah, (Marques-Silva hereinafter), GRASP: A Search Algorithm for Propositional Satisfiability (**see reference [6] listed in the Application description pg. 3** or PTO-892 Notice of Reference Cited dated 5/15/07).

31. As to claim 78, while the McMillan (2) method teaches almost all of the instant invention as applied to claim 75 above, the McMillan (2) method lacks using dummy variables.

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32. Marques-Silva discloses a method, wherein a lazy constraint is used instead of an eager I-literal constraint denoting an initial value of a flip-flop, an initial value constraint m is replaced by $(m+y)$ $(m+!y)$, where y is introduced as a dummy variable to delay propagation of effect of said initial value constraint in the satisfiability solver, said lazy constraint making it less likely that a flip-flop is marked due to its initial value constraint being present in the said unsatisfiable core, thereby leading to a smaller abstract model (see “dummy variable” in page 518, col. 2, 2nd–5th paragraphs).

33. McMillan (2) and Marques-Silva are analogous art because they are related to design verification.

34. Therefore, it would have been obvious to one of ordinary skill in this art at the time of invention by applicant to utilize the step of Marques-Silva in the McMillan (2) method because Marques-Silva develops a procedure for conflict analysis in satisfiability algorithms and describes a configurable algorithm for solving SAT (see page 516, col. 1, next to last paragraph, lines 1–3), and as a result, Marques-Silva reports the following improvement over his prior art: a SAT algorithm more efficient than other state-of-the-art algorithms for a large number of SAT instances (see page 516, col. 1, next to last paragraph, last 3 lines).

35. As to claim 79, Marques-Silva discloses a method, wherein a lazy constraint is used instead of an eager I-literal constraint denoting an environmental constraint, wherein an environmental constraint (m) is replaced by $(m+y)$ $(m+!y)$, where y is introduced as a dummy variable to delay the propagation of the effect of the said environmental constraint in the satisfiability solver, the said lazy constraint making it less likely that an external constraint node is marked due to its environmental constraint

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being present in the said unsatisfiable core, thereby leading to a smaller abstract model (see "dummy variable" in page 518, col. 2, 2nd–5th paragraphs).

Response to Arguments

36. Applicant's arguments filed 03/16/2009 have been fully considered, but they are not persuasive.

37. Regarding the Oath/Declaration remarks, (see page 7, 4th paragraph), the amendment had indeed corrected all deficiencies and the Oath/Declaration objections were withdrawn. The Examiner inadvertently checked the radio button in the previous PTO-326 Office Action Summary.

38. Regarding the claim objections, the amendment corrected some deficiencies.

39. Regarding the rejections under 101, Applicant's arguments have been considered but they are not persuasive. Claim rejections remain.

40. Regarding the rejections under 112, the amendment corrected some deficiencies.

41. Applicant argues, (see page 7, last paragraph to page 8, 1st paragraph), that "The Applicants respectfully submit that the '!' operator is well-known in computer science to represent a logical negation. For example, !A means NOT A. The Examiner is referred to any standard textbook in C or C++ which will define this operator. The Examiner is requested to withdraw the section 112, first paragraph rejection of claims 78 and 79". While ! may be used in C or C++ , according to the Specification, ' is used to represent a logical negation and not !. As is, logical negation has two different

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meanings, ' and !. Furthermore, ! changes the scope of the Specification. Rejection is maintained.

42. Regarding the rejection under 102 and 103, Applicant's arguments have been considered, but they are not persuasive. It is the Examiner's position that the cited references anticipate the claims and the rejections are maintained.

Conclusion

43. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

44. Baumgartner, Kuehlmann, and Abraham; Property Checking via Structural Analysis; (see PTO-892 Notice of Reference Cited dated 05/15/2007); teaches abstraction (see pgs. 3, 7, and 8).

45. De Moura et al., Pre-Grant publication 2004/0019468, teaches verification based on a lazy combination of a SAT solver with a constraint solver, introducing only the portion of the semantics of constraints that is relevant for constructing a BMC counterexample (see paragraphs [0070–3,0078,0083,0100,0142,0147,0153]).

46. Examiner would like to point out that any reference to specific figures, columns and lines should not be considered limiting in any way, the entire reference is considered to provide disclosure relating to the claimed invention.

47. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Juan C. Ochoa whose telephone number is (571) 272-2625. The examiner can normally be reached on 7:30AM - 4:00 PM.

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48. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Rodriguez can be reached on (571) 272-3753. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

49. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/J. C. O./ 4/22/09

Examiner, Art Unit 2123

/Paul L Rodriguez/

Supervisory Patent Examiner, Art Unit 2123